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# Effect of in-service training and workshops for teachers on students' ability to think creatively

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# EFFECT OF INSERVICE TRAINING AND WORKSHOPS FOR TEACHERS ON STUDENTS' ABILITY TO THINK CREATIVELY

by

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# INTRODUCTION

A need for developing the creative skills in youngsters has been clearly demonstrated. Taylor (21) has summarized this need as follows:

> The development of fully functioning individuals has long been an avowed purpose of education. For many years professors of education have talked enthusiastically about the development of the unique capacities of the individual child, but most teachers have been primarily concerned with instruction in a particular subject. . . . Currently there are pressures to limit the concern of education to the development of intellectual talents; those who would restrict the objectives of education in this way still urge that the schools be concerned with the full development of the intellect. Despite this proposed limitation in the definition of educational goals, if the intellectual capacities of the individual are to be fully developed, the abilities involved in creative thinking cannot be ignored. . . . Certainly we cannot say that an individual is fully functioning intellectually if the abilities involved in creative thinking remain undeveloped, unused, or paralyzed.

In Polk County a project has been designed to develop the creative skills of students. The project is called "Innovation and Motivation in Polk County for the Advancement of Creative Teaching" (IMPACT), and has emphasized individual study and how the teacher can best motivate the student in his pursuit of knowledge. The project was designed to create opportunities for the student to apply knowledge and skills rather than the traditional practices of transferring facts.

This study was an attempt to determine if creative thinking can be taught to students by providing in-service training in the area of creativity for teachers.

## Statement of the Problem

The general problem of this study was to determine if in-service programs for teachers, designed to teach creative teaching techniques,

can alter the teaching-learning situation to the extent that the children's ability to think creatively is improved.

More specifically, the problem was to test the following null hypotheses:

1. There is no significant difference among the groups as determined by the post-test scores of the students on the seven Torrance Tests of Creativity.
2. There is no significant difference among the grade level post-test scores of the students on the seven Torrance Tests of Creativity.

The Torrance Tests of Creativity were selected as the criterion variable. These tests were designed to measure growth as measured by the creative ability of those being examined in seven different areas. These seven areas are divided into two groups, the verbal and the figural. The verbal is composed of three subtests: verbal fluency, flexibility, and originality. The figural is composed of four tests: figural fluency, flexibility, originality, and elaboration. With different forms of these tests it was planned to measure the creative skills of the students and then to later retest to determine growth.

## Purpose of the Study

The purposes of the study were:

1. To provide an overview of methods of teaching creativity.
2. To survey the literature with respect to the current thinking

of the values of creative thinking.

3. To investigate the various methods used in measuring creativity.

4. To determine if creative thinking can be taught to students by instructing teachers in creative teaching techniques.

5. To evaluate the effectiveness of different types of in-service training in the area of creativity.

## Sources of Data

The data for this project were gathered from the following sources:

1. Project IMPACT, conducted by the Polk County Board of Education, in Des Moines, Southeast Polk Community Schools, and Johnston Community Schools.

2. The Iowa Tests of Basic Skills composite scores for the districts involved.

3. Creative test evaluations provided by Testing Service, Personnel Press, Inc., Princeton, New Jersey.

## Definition of Terms

Authoritarian Technique Teaching: Learning only what is accepted as the authoritative word, regardless of whether the authority is the teacher, parent, majority, or the consensus of the peer group.

Creativity: The mental processes that involve a set of intellectual talents which enable the mind to recombine known elements into something new.

Convergent thinking: When conclusions are completely drawn from given information. This type of thinking progresses toward a predetermined solution or answer.

Divergent thinking: The production of a wide variety of ideas, all of which are logically possible with the given information, and for which there is no predetermined answer or solution.

Inquiry Method or Discovery Method: Utilizes the theory of learning that is centered around the thinking and motivation of the child rather than the teacher. The children theorize from data which they have collected (genuine inquiry) and seek to discover the correct interpretation from the facts.

Intelligence: A small set of mental abilities measured by traditional intelligence tests.

Project IMPACT: "Innovation and Motivation in Polk County for the Advancement of Creative Teaching" (IMPACT) is designed as an in-service education program for teachers and school administrators consisting of institutes, workshops, and discussion meetings.

## Delimitations

This investigation was restricted to:

1. Thirty pupils in the Johnston Community School System (ten each from fourth, fifth, and eighth grades) during the 1967-68 school year.

2. Sixty pupils from the Southeast Polk Community Schools (20 each from fourth, fifth, and eighth grades), during the 1967-68 school year.

3. These pupils were taught by three teachers in the Johnston system and six in the Southeast Polk District. The three teachers in the Johnston School District had no workshop or in-service instruction. Three of the Southeast Polk teachers had participated in the IMPACT workshops while three had just in-service training conducted by employees of their district.

## Organization of the Study

The material presented in this study was divided into five chapters. The first chapter includes the statement of the problem and its purpose, sources of data, definition of terms, delimitations, and organization of the study.

Chapter Two contains a summarization and analysis of related literature and research. The review of literature presents a brief history of the development of the theory of creativity, the need for developing creativity in students, methods used to develop creativity in students, and the effectiveness of the techniques used to encourage teachers to use creative techniques.

The methodology and procedures for the study are discussed in Chapter Three. Chapter Four is a discussion of the findings of the data collected from the students who were tested.

In conclusion, Chapter Five deals with the summary pertinent to the investigation and recommendations for further study.

# REVIEW OF LITERATURE

## Introduction

"Creativity" is becoming a common term in our everyday vocabulary. It is the topic of many educational organizations' meetings, institutional workshops, and recreational planning programs. Quite frequently its meaning and focus are misguided by uninformed leadership or misinterpretation of facts, but more important, the creative achievements of man are being recognized and studied.

From the earliest writing to man, creative concepts have been investigated. Plato (12) writes of the "uncontrolling abilities" of thought and action in the human being. It was his belief that our creator was the absolute ruler of our minds and no human endeavors could change the course of thought or action. From this narrow viewpoint creativity was considered a divine gift emerging from inspiration rather than from education. In 1869 Galton attempted to draw conclusions from a study of men of genius through studying the hereditary determination of creative performance (9). Also during the nineteenth century Cesare Lombroso, after analyzing the men of genius and identifying creativity with the neurotic and insane, advocated the need to explain creativity pathologically. Creativity, such as an artist's abilities, was thought to be an emotional purgative that kept men sane.

From that time on, sporadic attempts were made to unveil the potential of creative talents and their relationship to other known concepts.

In 1898 Dearborn (9) constructed a productive imagination test, and from his research a relative independence was noted between tests of the

creative category and the tests of intelligence scales. Then in 1906 Terman tested youngsters placed in bright and dull groups as determined by the teacher in charge. A set of experimental tests, one now recognized as the test of ingenuity, were administered to the two extreme groups. The test of ingenuity showed no relationship between the two extremes and creative potential was ruled out of intelligence.

A few anecdotal studies by non-psychologists during the late 1920's resulted in a list of stages of thinking typically utilized in the total process of thinking. These studies were designed to encourage more creative thinking among students and little contribution to theory was evident (9). Other than the studies presented here, little was discovered in the area of creativity before 1950. Educators and psychologists were too busy measuring pupil achievement by the single factor of intelligence.

At a presidential address to the American Psychological Association in 1950 Guilford stressed the need for more information on creativity to his fellow members (8). He cited the results of his personal research in which less than two-tenths of one percent of all books and articles indexed in Psychological Abstracts for approximately a quarter of a century dealt directly with the creative activities. Up to this time the traditional intelligence tests were the basis for evaluating creative potential. A concentrated study to explore certain neglected areas regarding gifted, cognitive, and psychosocial functioning revealed the need for a broader and more defined meaning of intelligence (6).

One significant discovery by Torrance was the lack of correlation between creative potential and the traditional concept of the intelligence test. When administering an IQ test to an experimental group,

the only substantial correlation found by the investigators was that between the low intelligence group and their low level of creative potential. Torrance further emphasizes this lack of correlation when he stated that if an intelligence test were used as a basis for selecting top-level talent, about 67 percent of the persons with the highest scores on a creativity battery would be missed (22). School grades, academic knowledge, and years of education were not found to be indicative of creativity. To predict later creative performances it was necessary to introduce creative activities which could be evaluated.

Intelligence (in a very narrow meaning) measures no more than eight intellectual talents (9), these talents being the cognitive abilities or the amount of basic information possessed (22). In a broader sense, intelligence covers the total intellect, that which the human mind is potentially able to do. This would include many types of giftedness or talents (9).

## Divergent-Convergent Thinking

Out of the research dealing with intelligence and measurement of creative potential came new tests of measuring creative potential. One of these was Guilford's "Structure of the Intellect" (8). Through factor analysis Guilford claimed to have identified 60 different abilities having to do with intellectual activities. Now, rather than only a few primary abilities, many abilities could be combined to represent the total intellect. In 1962 at the Fifth Utah Creativity Conference, Guilford presented an addition of two new abilities (21), and predicted that the original 60 abilities could be increased half again as much with new discoveries (10). Guilford's two concepts, divergent and

convergent thinking, have provided a means of measuring creativity. In divergent thinking the goal is to produce a variety of ideas, all of which are logically possible with the given information (10). From this meaning, other abilities have been defined such as "ideational fluency," divergent production of transformation and divergent production of implications (10). Emphasis is placed on fluency of ideas, originality, elaboration, and flexibility (3). When conclusions are completely drawn from given information, convergent thinking is in operation. Often the teacher encourages this type of thinking when a particular answer is desired. Abilities involved in convergent thinking involve symbol substitution, numerical facility, and deduction (3). Convergent thinking is emphasized in the traditional methods of teacher education.

Guilford believes that divergent-production and transformation abilities are the most pertinent in creative thinking development (9). When many ideas are necessary, brainstorming seemed to encourage creative talents. The variety of abilities will depend greatly on the person's informational background, or the environmental media. With that attained total knowledge, the person further uses his creative potential by transforming and revising ideas.

Contrasted to this fluency, flexibility, one must look at the authoritarian technique of teaching. Torrance describes authoritarian teaching as learning only what is accepted as the authoritative word, whether the authority is the teacher, parent, majority, or the consensus of the peer group. When teachers insist on this type of learning, the creative thinking abilities are partially wasted (23).

One must not discount the environmental or cultural factors which

evolve around the divergent thinking processes. In our society today there are many cultural influences which tend to thwart the growth of creative talents. There is an over-emphasis on success and the fear of failure and punishment which results in student reluctance to experiment or question. Social pressures and conforming to the norm remove uninhibited creative development. Creative behavior requires both sensitivity and independent thinking. In our social order females are seen as sensitive and receptive, and the male is portrayed as an independent thinker. If divergency from these behavioral norms can be instituted, creative progression can take place. Torrance points out that these alterations in cultural influences, primarily done through the behavior of the teacher, can nurture creativity (27).

Guilford, reviewing progress in creativity, concluded that changes in performance can be assessed and improvements with some degree of durability do occur (9). This is further strengthened by the results of recent studies.

## Related Research

Larson (14) studied the effect of extending the boundaries of awareness at the junior high level using Kubie's theory of preconscious, which states that without the preconscious system there can be no true creativity. The influences of the conscious and the unconscious govern the preconscious state by allowing reality through consciousness, and yet the unconscious attributes freedom from criticism and all realism (13). Within this theory, creativity flows equally from both conscious inhibitions and repressive unconsciousness.

The experimental group was introduced to special sessions which encouraged divergency from the norm. The control group studied under the traditional patterns. Analysis of the findings revealed that, although the study had only been in operation for four years, the experimental teachers' capacities for empathy, flexibility, spontaneity, and adapting did prove beneficial to the cultivation of creative talents in the pupils. Through this teaching-learning environment it was established that students do need help in learning to appreciate complexities that have a tendency to be so simple. It was also noted that the effect the study had on the teachers and investigators was encouraging. The role of the teacher became more important, teaching methods changed, and the school and its activities had more meaning to all involved.

Ivo Grief (7) attempted to improve the ability of pre-service teachers to teach creativity. Twenty-four student teachers were placed in a special concentrated study which emphasized creative and critical thinking in methods of teaching arithmetic and language arts. The Watson-Glaser Critical Thinking Appraisal, the Southern California Tests of Creative Thinking Abilities, a teaching evaluation record, and a teacher observation record developed by the writer were given at the beginning of the study. The students were then instructed in special methods of planning and directing learning experiences for children that would encourage creative and critical thinking. After a post-test, high gains (at the .01 level of significance) were noted in the ability of the student teacher to encourage children to think creatively and also in the general teaching techniques and their ability to think creatively and critically (7).

Yamamoto (36) has studied the teacher influence on pupil learning in the area of creativity. He concluded that due to the complexity of creativity, possible side benefits from interaction of the creative teacher and the student might result, but the possibilities were yet unmeasured by achievement tests. Later Yamamoto emphasized the need for educators to evaluate procedures for selecting and preparing teachers (35). From this same study he concluded that just because a teacher produces a high creativity level does not mean that this creative potential will be transmitted to all her students. He recommended a program of matching the teacher's abilities and personalities with those of the student's characteristics. Elementary teachers should be specialized to create the best combination of pupils, teacher, and subject area. Traditionally, the teacher learns and adjusts to the existing school system. Yamamoto concluded that there are advantages in reversing this policy and adjusting the system to the man. He re-emphasized the need to constantly re-evaluate one's educational value system in relationship to his own personal development.

Insight ability was tested in a study by Anderson (2) in which he trained an experimental group of sixth grade boys through the use of the brainstorming technique. During the brainstorming sessions, ten 30-minute sessions, the boys were directed by the experimenters to state unusual uses of familiar objects. To explore the relationship between amount of variety in training and transfer, the experimental group was divided into a high-variety training program and a low-variety training program. In high-variety, 30 distinctly different objects were examined while in the low-variety group 30 objects in six related categories were

used. At the end of the training period the experimental groups and the control group, who had no special treatment, were given a Novel Uses Test. Although there was no significant difference in the originality between the high and low-variety training, the mean originality score of the trained groups was significantly higher than that of the control group. Transfer of training was difficult to determine and Anderson felt that there would be more conclusive results if a larger sampling were gathered and if more intensive, carefully planned training procedures were introduced (2).

Williams[1] has been involved in several projects where he worked with the teachers after he realized the teacher's inability to identify creative talent or to understand the scope of creativity. Without special training teachers were unaware of the abilities of the creative person and what teachers could do to encourage and help develop potential creativity. He designed the National Schools Project, a pilot program sponsored by the U.S. Office of Education to train entire staffs of several elementary schools across the United States.

Using an expansion of Guilford's three-dimensional model, Williams classified teaching strategies through which the teachers were encouraged to experiment on their own after a period of in-service training. During the in-service training period, materials and techniques were demonstrated to expose the teacher to how various subject matter areas could be taught which would result in guiding students to think through the use of all their mental processes; in other words, development of productive-divergent thinking. He theorized that creativity can be cultivated in all areas and

[1]Williams, Frank E., Des Moines, Iowa. Is creativity an innovation in education? Private communication. 1967.

that through in-service education teachers began to innovate and experiment with their own ideas. Through the efforts of teachers and the investigators, an experimental-pilot workbook with the purpose of exchanging and testing all materials and ideas of the program was produced.

Another program with objectives similar to those of Williams, that of guiding teachers to promote creative expression, was a research project under the leadership of Stone (20). He conducted an extensive review of creative literature as it pertained to the elementary curriculum, child growth, and developmental and educational psychology. After evaluation of the review, 15 principles of creativity-in-teaching were adopted (20, pp. 95-96):

1. Creative expression has both social and personal significance and should be fostered in the elementary school.

2. All children are capable of creative expression to some degree.

3. Creativity is a complex process involving a concept of one's self and relating to one's environment.

4. Preparation, activity, time, and flexibility of thought aid the production of a creative product.

5. Evaluation aids the completion of a creative product.

6. Children may show differences in both degrees and areas of creativity.

7. An adventuring attitude incorporating effort and experience is characteristic of creative expression.

8. Imagination is characteristic of creative expression.

9. Creativity may be developed in all subject areas, in all school endeavors, and may involve any media or mode of expression.

10. The creative teacher utilizes learning principles to promote creative expression.

11. The creative teacher stimulates creative expression through his own attitude and example.

12. The creative teacher provides experiences, concepts, and skills as a basis for creative expression.

13. The creative stimulates creative expression within a democratic environment.

14. The creative teacher values process as well as product.

15. The creative teacher utilizes problem solving as a basis for further creativity.

As a second part to the project, a guide for elementary teachers was written based on suggestive application of the principles (20).

Reliability of creativity research

Up to this point not much has been said as to the reliability of studies in creativity. As with all areas of research, tests must be developed to evaluate findings. Torrance tried to adapt Guilford's materials to prepare a test for grades kindergarten through graduate school. Torrance disagreed with Guilford's Structure of the Intellect in that Guilford's predictor measures represented single factors (25, p. 45). Alternate forms of Guilford's structure were developed and tasks that would be models of the creative process and would require several types of thinking were constructed. All tasks involved production of divergent solutions, multiple possibilities, and some type of thinking involved theoretically in creative behavior (25, p. 45). Using the set of tests he had developed, Torrance studied the creative changes as a function of age in children and adolescents and revealed that there was no uniform rate of development. There was a definite "fourth-grade

slump," and he also noted a leveling off of creative behavior in the late teen years (9).

On a survey of studies which examined the results of the Minnesota Tests of Creativity a list of 84 characteristics was compiled that differentiated highly creative persons from less creative ones. This list included such characteristics as discontented, never bored, attracted to disorder, not interested in small details, emotional, and oddities of habit. Torrance went on to explain these characteristics in relationship to the creative teacher. Generally speaking, they are highly sensitive of students' needs, resourceful, flexible, and most always well accepted by students. To the colleagues of the highly creative person he may seem childish, uncultured, fault-finding, and irritable. Students who received high scores on the Minnesota Tests of Creativity are usually nominated by their peers and teachers as being the most talkative or as having "wild ideas" (25).

Torrance (32) also pointed to the progress in creative instruments. Research efforts in the past ten years have helped teachers gain and utilize skills of creativity through the development of tests of creative thinking, measures of creative motivation, preferences for learning in creative ways, and aids for teacher identification of creative potentialities.

## Teachers' Role in Creativity

Guilford (10), when discussing the need for reading teachers to encourage children to think, referred to psychological tests that show indications of creative abilities. The Unusual Uses Test, which tests the ability to produce a variety of class ideas, and an Associational Fluency

Test, where the ability to produce a variety of responses involving relationships are tested, were explained. Guilford stresses the need of teachers to experiment with the suggested tests to develop their own tests of ability. By using these suggestions it seemed probable that the teacher's abilities to think critically and creatively would be greatly improved.

Stanford Research Institute (5) was considering adopting a problem-solving course for their employees. To acquire first-hand data on existing problem-solving courses, 34 organizations in the United States replied to their questionnaire, including industrial corporations, consulting firms, a research organization, and several colleges and universities. All of the courses taught abilities associated with creativity, innovation, and creative problem-solving. Some courses also reported stressing specialized areas such as work simplification, management development, and decision-making. They utilized demonstrations, lectures, group discussions, and student involvement exercises. Emphasis on practical work situations was reported by many organizations. The courses were evaluated by several tests, such as A. C. Test of Creative Ability, Guilford's tests, and Barron's tests. Strong indications of the courses' success was also evaluated by the reported production increases in the industrial organizations and the self-confidence, flexibility, and improvement in imagination, and uninhibiting qualities of the participants. Stanford is now organizing an experimental course derived from the results of their study. Educators cannot overlook the progress industry is making in their efforts to train better workers through creativity.

Arnold Toynbee stated, "In any human society, at any time and place and at any stage of cultural development, there is presumably the same average percentage of potentially creative spirits" (33, p. 3). The key word in his statement seems to be "potentially" and conclusions drawn from recent studies agree that creative abilities can be increased. Of the 40 studies evaluated by Parnes and Brunelle, 90 percent of the total indicated that the subjects' creative-productivity levels were significantly increased by deliberate educational programs (17, p. 54). Parnes and Brunelle have evaluated the research being done on the nurture of creative behavior and pointed out the recent trend in studies has been in relation to heredity and environment. In the last year and one-half, 1,250 bibliographic entries were noted. Prior to 1965, only about 300 relevant doctoral dissertations were submitted. In the last year and one-half, 200 more dissertations have been cited.

Torrance (32) reminds educators that quantity does not always measure quality. Although several thousand are trying to develop skills, he believes workshops and institutes lack the essential skills to identify and acknowledge creative potential, and then to facilitate and develop these skills into classroom situations.

To justify a change from the norm, a need must be shown. Observing our educational systems of today and the progress of our world, Chamberlain (4) sums up these needs. Due to changes in our way of living, new methods, automation, technological, there is a need for teachers to be re-educated. About half of what a person has learned will be obsolete in a decade and about half of what he will need to know ten years from now is not available to him now. This is true of the professional people

as well as the manual workers. The educational program must stimulate and encourage the development of the full intellectual capacities so the challenges of our ever-changing world can be met (34).

The American Association of School Administrators has spent considerable time studying the individual in the school setting. The basic areas of teaching are geared for learning in a group situation but it must be remembered that only the individual can learn. Teachers need to employ a climate to stimulate growth in education through the introduction of all sorts of inventiveness thereby utilizing the maximum of tools for learning (1). Kneller also felt that individuality is most important. "Pupil and teacher must be rescued from a system that no longer educates individuals but processes multitudes" (12, p. 99). He suggested that maybe it was time for some teachers to go into private practice experimentally (12).

Torrance sees the need for teachers to understand and increase their own creativity (24). This need has been expressed earlier in some of the studies surveyed. There would be a definite improvement in the mental health area of the teaching profession if this were achieved.

The American Association of School Administrators advocates a goal of all administrators and teachers to seek to permit and stimulate diversity rather than commonality to promote, in all areas of teaching, divergent specialized potentials of every pupil (1).

Kneller (12) outlined an ideal creative educational system. All barriers between teacher and pupil must be removed to encourage freedom of thought and action. Teacher specialization would be necessary with the teacher being responsible for no more than 12 students. More time

would be necessary for personal and intellectual growth by partially removing full class days and allowing students and teachers to become more involved in community projects.

In more conservative methods of innovation Torrance lists several areas where the teacher's role can provide a "creative relationship" with his pupils (23):

1. Provide a curriculum with many opportunities for creative achievement and give credit for self-initiated learning.

2. Respect the unusual questions and idea submitted by the pupil.

3. Show that the students' ideas have value.

4. Provide chances for learning and discovery without the threats of immediate evaluation.

The best route to achieving the goals of creative teaching seems to rest in the development of in-service education. Curriculum changes were discussed in a recent report of the ASCD's commission of current curriculum developments. This report suggests that committed teachers must be ready to continue their education. The success in curriculum developments can be attributed to institutes and other types of in-service training and lags in curriculum can be minimized. The commission sees the problems of expanding in-service education which would greatly increase the budget, but even more important, the problem of making the in-service program an integral part of the whole educational system. Inservice education can not be a "tacked on" activity. Through the introduction of new staff utilization patterns, new class organization and mechanical devices and precise division of responsibility for information teaching can be implemented (34).

## Summary

Creativity is a current topic of many educational institutions, and throughout history creativity has stood for many different things. It has been described as a gift--something not to be tampered with. It has been identified with those who are insane or neurotic, and it also has been described as a power which kept men sane. Since the turn of the century research in creativity has been formally initiated. Creativity was thought of as something separate from, and not a part of, intelligence. It was later revealed that high intelligence did not necessarily indicate high creativity. In the broader sense of intelligence, creative ability was included. From this broader definition new means of measuring creative potential were constructed. Guilford's "Structure of the Intellect" discovered 60 different intellectual abilities. Guilford's main concepts dealt with divergent and convergent thinking. Convergent thinking involves symbol substitution, numerical facility and deduction. This type of thinking has been emphasized in present-day education. Divergent thinking involves fluency, originality, elaboration, and flexibility. This type of thinking nurtures creativity.

Research concerning creativity is continuing at a rapid pace, and indications at present point to the idea that certain types of creativity can be imparted to the students from the teacher, and that teachers can learn these innovative techniques in in-service training. The research on the reliability of this creative research has been conducted mainly by Guilford and Torrance. Their independent research indicated that there is a relationship between the test results and the performance of the students in school and, with these measuring instruments, teachers can

identify potential creative ability. Due to our changing society, teachers need to be continually re-educated. Torrance indicated that teachers need to understand and increase their creativity. In-service education appears to be the best method of achieving our goals in creativity. Teachers must be ready to continue this education, and administrators must be ready to pay for it. In-service training must be an integral part of our total educational system.

# METHOD OF PROCEDURE

## Selection of the Population

This study was designed to determine if the teaching-learning situation could be altered significantly by presenting materials on creativity to teachers in workshops and in-service training. The students of these teachers were measured for their creativity before and after their teachers had received in-service training. This was done to determine if their ability to think creatively had been measurably affected by the exposure to the creative teaching techniques presented by their teachers.

### Teachers

The teachers used in the study were selected on the following basis:

1. Teacher Group One had participated in Project IMPACT.
2. Teacher Group Two had experienced in-service training.
3. Teacher Group Three had not participated in Project IMPACT or experienced in-service training.

The teachers who participated in Project IMPACT were selected for this project on the basis of their teaching ability. They were chosen by their administrators to participate.

The teachers from Southeast Polk all experienced some in-service training on creativity. From this group three were selected who taught the same subjects as the teachers who participated in Project IMPACT, but they had not, themselves, participated in Project IMPACT.

The teachers who represented the control group were selected on the basis of the subject matter they taught. The three teachers at the junior high level all taught mathematics. The elementary teachers of

the three groups taught self-contained classes at the fourth and fifth grade level.

Students

The Torrance Tests of Creativity were administered to a total of 90 students. Sixty of these students were enrolled at Southeast Polk Community School, and 30 of the students were enrolled at the Johnston Consolidated School.

Thirty Southeast Polk students were selected because their teachers had participated in workshops and in-service training on creativity. These students represented grade levels four, five, and junior high. Within this selected sample, the students were chosen at random to take the Torrance Tests of Creativity. The scores obtained on the creativity tests were compared to the Iowa Tests of Basic Skills to examine the relationship of creativity to academic achievement.

The procedure was repeated for 30 other students at Southeast Polk whose teachers had in-service training on creativity but had not participated in the workshops on creativity. These students also represented grade levels four, five, and junior high, and were selected at random.

The 30 remaining students were selected at random from grade levels four, five, and junior high at the Johnston Consolidated School. The comparison was the same for this group as the two previous groups, except their teachers had not been exposed to any creative teaching techniques in workshops or in-service training.

Testing

The Torrance Tests of Creativity were administered to the selected

sample of 90 students during the month of November 1967. This first test was administered to the students prior to any exposure to the creative teaching techniques that the teachers were in the process of learning from their workshops and in-service training. The teachers had at this time been exposed to a limited amount of creative teaching techniques, but it was assumed that this exposure was so limited, and that teachers had such little time to formulate their own ideas, that this would not have filtered down to the students. The second administration of the Torrance Tests of Creativity took place during the month of May 1968. This administration took place after the students had been exposed to various creative teaching techniques. The two obtained test scores were compared to see if there was any significant change in the creative ability of the student.

The Iowa Tests of Basic Skills were used to measure the equality of the control group and the experimental groups. This measure was introduced as a co-variant to determine if there was a relationship between the achievement level of the student and the creative ability of the student. The Iowa Tests of Basic Skills provide for comprehensive measurement of the following fundamental areas: vocabulary, reading, the mechanics of correct writing, methods of study, and arithmetic. These skills are crucial to the total educational development of the pupil. They largely determine the extent to which he can profit from later instruction.

The primary purpose of the tests was to reveal how well each pupil had mastered the basic skills.

## Description of the Treatments

### Project IMPACT

The word IMPACT stands for Innovation and Motivation in Polk County for the Advancement of Creative Teaching. It is a federal project granted to the Polk County Board of Education and Title III of Public Law 89-10. The requested funds totaled 264,221 dollars.

Project IMPACT is designed as an in-service education program for teachers and school administrators. Institutes, workshops, and discussion meetings were employed as instructional techniques for the participants. Teachers who participated in the six workshops received over 90 hours of creativity training.

Major objectives of the project included:

1. To review selected literature on creativity.
2. To cultivate the attitude that teaching techniques may be as important as content.
3. To accentuate the dignity and value of each individual and his contributions.
4. To stress curriculum organization plans which facilitate creative and productive thinking.
5. To provide an opportunity for teacher in-service education.
6. To involve the project participants in the evaluation of the project.

The purpose of this project is to stimulate productive action within Polk County for the implementation of innovative practices necessary for education in a rapidly changing society.

IMPACT proceeds on the premise that the creative potential of students can be nurtured within the framework of the existing school organization and curricular structure.

IMPACT was designed to add to the teachers' knowledge about creativity and improve their skill in fostering creative student behavior in the classroom.

In-service training

In the early part of the 1967-68 school year, the Southeast Polk Schools were given one day of training on creative teaching and how to stimulate creative thinking in the students. The inquiry method was presented to the teachers, and different techniques on how to develop this method were discussed. The teachers discussed among themselves how the inquiry method could apply to their students. Not all of the teachers accepted these ideas and some did not feel that they wanted to try them in their classrooms. The teachers agreed to meet on a weekly basis and discuss how these techniques work and how various teachers applied them. These teachers at each grade level met each week for a short time to discuss their progress and learn new ideas. The people who presented the first program returned for some reinforcement in creative teaching techniques in the middle of the semester. The total amount of creativity training was approximately 30 hours.

A book on creativity, Institute for Behavioral Research in Creativity by Sumanski, was made available to the teachers. There were several teachers from Southeast Polk participating in Project IMPACT and after each workshop these teachers would report back to the faculty at regularly scheduled faculty meetings.

Control group

The Johnston Community School was selected as a control group because of the similarity of this school district with the Southeast Polk School District. Both schools are:

1. Suburban school districts.
2. Have students of moderate income and socio-economic background.
3. Recruit teachers from the same teacher-training institutions.
4. Have similar teacher salary schedules.
5. Are nearly the same size.

The Johnston faculty had no formal exposure to the creative teaching techniques.

Torrance Tests of Creative Thinking

The tests have been made available for general use in research and experimentation after nine years of research and development by the author and his associates at the University of Minnesota.

A variety of approaches have been used to experiment with various age and educational groups. Certain approaches had to abandoned because they were not valid, or were too expensive, too elaborate, or required materials and equipment that were too difficult to make available for widespread use.

The Torrance Tests of Creativity are composed of: Verbal Form A, Verbal Form B (an equivalent alternate form to Verbal A), Figural Form A, and Figural Form B (an equivalent alternative form to Figural A). Both figural and verbal forms can be used from kindergarten through graduate school.

The Verbal Tests consist of seven parallel tasks, each battery requiring a total of 45 minutes. Each task is believed to bring into play somewhat different mental processes, yet each requires the subject to think in divergent directions, in terms of possibilities. The activities involve asking questions about a drawing, making guesses about the causes of the event pictured, making guesses about the possible consequence of the event, producing ideas for improving a toy so that it will be more fun for children to play with, and thinking of the varied possible ramifications of an improbable event.

The Figural Tests include three activities with an overall administration time of 30 minutes. In designing them, the author made a deliberate effort to obtain a maximum of information from a minimum of testing time. The first task, Picture Construction, is designed to stimulate originality and elaboration. The two succeeding tasks, Incomplete Figures and Repeated Figures, increasingly elicit greater variability in fluency, flexibility, originality, and elaboration. There is not enough time to complete all of the possible units and make them highly elaborate or original. Thus, response tendencies and preferences emerge as a result of time pressure.

In devising the scoring procedures presented in the Scoring Guides, an effort has been exerted to make the evaluation of responses as simple and as economical as possible without sacrificing any of the essence and richness of the records.

## Treatment of Data

The primary objective of the experiment was to assess the relative effectiveness of the types of programs presented to selected teachers on

creativity as compared to a group of teachers who had not been exposed to any special creativity training.

The design of the experiment was intended to determine if the relative effectiveness of the three groups differed by the classification groups and the grade level.

Analysis of covariance was used to determine what effect these items had on the individual student's ability to learn creativity. The covariant was achievement level.

The covariant achievement level was measured in terms of the student's composite scores on the Iowa Tests of Basic Skills. Each student was classified as high achievement if his composite score exceeded 34, or as low achievement otherwise.

The value 34 (based on 99 maximum) was chosen so that approximately one-half of the subjects were contained in each group, as shown below in the distribution of the population.

| | workshop | in-service | control |
|---|---|---|---|
| high achievement Fourth grade | 10 | 5 | 4 |
| low achievement | 0 | 5 | 6 |
| high achievement Fifth grade | 4 | 4 | 5 |
| low achievement | 6 | 6 | 5 |
| high achievement Junior high | 8 | 0 | 4 |
| low achievement | 2 | 10 | 6 |

The appropriate analysis for the experiment can be defined as multi-factor analysis of covariance. The factors consisted of group and grade level. The covariant used on the experiment was achievement

level.

The sources of variability and the effects isolated in the analysis can be shown by means of the following linear model:

$$Y_{ijK} = \mu + \alpha_i + \tau_j + \epsilon_{ij} + \beta(x_{ijK} - \bar{x}...) + \delta_{ijK}$$

where:

$Y_{ijK}$ = the association between pre- and post-test (post minus pre) for the kth student in the ith group and the jth grade level

$\mu$ = the overall mean

$\alpha_i$ = ith observation of the treatments

$\tau_j$ = jth observation of the grade levels

$\epsilon_{ij}$ = random error

$\beta(x_{ijK} - \bar{x}..)$ = covariance term, when X is achievement level for the kth student within the ith group and jth grade level

$\delta_{ijK}$ = error associated with kth student within ith group and jth grade level

$i^{th}$ = 1 (workshop), 2 (in-service), 3 (control)

$j^{th}$ = 1 (fourth grade), 2 (fifth grade), 3 (junior high)

# FINDINGS

## Introduction

Seven subtests comprise the Torrance Tests of Creative Thinking. Therefore, the findings of each subtest will be presented separately. Since the two hypotheses concern the seven subtests as a unit, the testing of the hypotheses will follow the individual findings of the seven subtests.

## Variable 1: Verbal Fluency

The mean scores achieved on the post-test by each group and grade on the Verbal Fluency subtest of the Torrance Tests of Creative Thinking are shown in Table 1. The in-service group showed the highest mean (41.10),

Table 1. Mean post-test scores by group and grade: verbal fluency*

| Grade level | Group | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Overall mean |
| 4 | 26.44 | 28.70 | 38.78 | 31.31 |
| 5 | 41.78 | 81.90 | 37.10 | 53.59 |
| Junior High | 48.20 | 12.70 | 27.60 | 29.50 |
| Overall mean | 38.81 | 41.10 | 34.49 | 38.13 |

*N = 10 in each sub-classification.

with the workshop group next (38.81), and the control group reporting the lowest mean (34.49). Fifth graders showed the highest mean score when the values were compared by grades, with a mean of 53.59, considerably higher than the other two grades. The fourth grade showed a mean of 31.31, and the junior high reported the lowest mean, 29.50. The fifth grade in-service group had the highest mean, 81.90, while the fourth grade workshop

group achieved the lowest mean, 26.44. The overall mean for the post-test of Verbal Fluency was 38.13.

The mean differences of post- and pre-test scores (post-test score minus pre-test score) by group and grade for the Verbal Fluency subtest are shown in Table 2. The overall mean difference was -.08. Specific negative values were reported by the fourth grade control group (-14.78), and the junior high control group (-12.20). The greatest positive value, indicating a gain, of 9.20, was achieved by the fifth grade control group. Positive gains of 3.02 and 2.67 were reported by the workshop and in-service groups, respectively, with positive gains in all grades for these groups.

Table 2. Mean differences of pre- and post-test scores by group and grade: verbal fluency

| Grade level | Group | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Overall mean |
| 4 | 5.78 | 3.90 | -14.78 | -1.70 |
| 5 | 1.89 | 4.00 | 9.20 | 5.03 |
| Junior High | 1.40 | 0.10 | -12.20 | -3.56 |
| Overall mean | 3.02 | 2.67 | - 5.93 | - .08 |

Using the differences, post-test minus pre-test, an analysis of covariance was used to assess differences between groups and between grade levels on the students' performance in the Torrance Tests of Creative Thinking. The covariate used was the students' test scores on the Iowa Tests of Basic Skills (composite). This variable may be considered as a measurement of student ability. This analysis is shown in Table 3. The computed F-values of 1.55 for the grades and 1.22 for the groups were not

significant. After adjusting for individual differences in ability, there were no significant differences between either group or grade level on the post-test minus pre-test differences of the Verbal Fluency subtest.

Table 3. Analysis of covariance of mean differences of pre- and post-test scores: verbal fluency

| Source of variation | d.f. | Sum of Squares | Mean Square | F-value |
|---|---|---|---|---|
| Grade levels | 2 | 1581.13 | 790.57 | 1.55 |
| Groups | 2 | 1246.61 | 623.31 | 1.22 |
| Error | 4 | 2038.62 | 509.66 | - |
| Students within class | 77 | 25970.68 | 337.28 | |
| Total | 85 | 29857.04 | | |

Variable 2: Verbal Flexibility

Table 3 shows the mean post-test scores by group and grade on the second subtest, Verbal Flexibility. These values were identical to those of Variable 1, Verbal Fluency, shown in Table 1. Again, the in-service

Table 4. Mean post-test scores by group and grade: verbal flexibility

| | Group | | | |
|---|---|---|---|---|
| Grade level | Workshop | In-service | Control | Overall mean |
| 4 | 26.44 | 28.70 | 38.78 | 31.31 |
| 5 | 41.78 | 81.90 | 37.10 | 53.59 |
| Junior High | 48.20 | 12.70 | 27.60 | 29.50 |
| Overall mean | 38.81 | 41.10 | 34.49 | 38.13 |

group had the highest mean, followed by the workshop and control groups. Fifth grade had the highest mean of the grades, and the fifth grade in-service group showed the highest mean of the nine combinations. The

overall mean was 38.13.

Data contained in Table 5 are the mean differences of pre- and post-test scores by group and grade for verbal flexibility. The overall mean difference was 1.24. The highest mean difference was 4.90, achieved by the

Table 5. Mean differences of pre- and post-test scores by group and grade: verbal flexibility

| Grade level | Group | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Overall mean |
| 4 | 2.33 | 3.80 | -3.00 | 1.04 |
| 5 | 2.22 | 1.60 | 4.90 | 2.91 |
| Junior High | 1.60 | .20 | -2.50 | - .23 |
| Overall mean | 2.05 | 1.87 | - .20 | 1.24 |

fifth grade control group, but the other two control mean differences were negative, resulting in an overall mean difference of -.20 for the control group. Other mean differences were positive, ranging from a high of 3.80 for the fourth grade in-service group to a low of .20 for the junior high in-service group. The workshop group had an overall mean of 2.05 while the in-service group reported 1.87. Junior high was found to have an overall mean difference of -.23, while fourth and fifth grade values were positive, 1.04 and 2.91, respectively.

The analysis of covariance, shown in Table 6, revealed a non-significant F-value in analyses of group and of grade.

### Variable 3: Verbal Originality

Values in Table 7 show the same mean post-test scores as were reported in Variables 1 and 2, shown in Tables 1 and 4.

Table 6. Analysis of covariance of mean differences of pre- and post-test scores: verbal flexibility

| Source of variation | d.f. | Sum of Squares | Mean Square | F-value |
|---|---|---|---|---|
| Grade level | 2 | 107.17 | 53.58 | 1 |
| Group | 2 | 190.12 | 95.06 | 1.51 |
| Error | 4 | 252.49 | 63.12 | - |
| Students within class | 77 | 5700.19 | 75.31 | |
| Total | 85 | 6348.97 | | |

Table 7. Mean post-test scores by group and grade: verbal originality

| | Group | | | |
|---|---|---|---|---|
| Grade level | Workshop | In-service | Control | Overall mean |
| 4 | 26.44 | 28.70 | 38.78 | 31.31 |
| 5 | 41.78 | 81.90 | 37.10 | 53.59 |
| Junior high | 48.20 | 12.70 | 27.60 | 29.50 |
| Overall mean | 38.81 | 41.10 | 34.49 | 38.13 |

Mean differences of pre- and post-test scores by group and grade are shown in Table 8. The overall mean difference was 6.84. The control

Table 8. Mean differences of pre- and post-test scores by group and grade: verbal originality

| | Group | | | |
|---|---|---|---|---|
| Grade level | Workshop | In-service | Control | Overall mean |
| 4 | 13.67 | 4.60 | 4.78 | 7.68 |
| 5 | - 1.78 | 4.40 | 18.60 | 7.07 |
| Junior high | 1.30 | 7.00 | 9.00 | 5.77 |
| Overall mean | 4.40 | 5.33 | 10.80 | 6.84 |

group was noted to have the highest total mean, 10.80, while the in-service group reported a score of 5.33, and the workshop group indicated a mean difference of 4.40. The fourth grade earned the highest mean difference of the grades, 7.68, followed by fifth grade with 7.07, and junior high with 5.77.

The analysis of covariance is shown in Table 9. The F-values were found to be nonsignificant.

Table 9. Analysis of covariance of mean differences of pre- and post-test scores: verbal originality

| Source of variation | d.f. | Sum of Squares | Mean Square | F-value |
|---|---|---|---|---|
| Grade level | 2 | 642.86 | 321.43 | 1 |
| Group | 2 | 68.41 | 34.21 | 1 |
| Error | 4 | 1953.08 | 488.27 | - |
| Students within class | 77 | 13969.60 | 181.42 | |
| Total | 85 | 22033.95 | | |

Variable 4: Figural Fluency

Mean post-test scores by group and grade for the subtest of Figural Fluency are shown in Table 10. The highest mean of the groups, 41.13, was achieved by the workshop group, followed closely by the in-service group with 41.10. The control group showed a mean score of 34.17. The fifth grade reported the highest mean score of the grades, 54.00. The fourth grade was next with a mean score of 32.90. The junior high followed with a score of 29.50. Overall mean score of the entire population was 38.30.

Table 11 reports the mean differences of the pre-test and post-test

Table 10. Mean post-test scores by group and grade: figural fluency

| Grade level | Group | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Overall mean |
| 4 | 32.20 | 28.70 | 37.80 | 32.90 |
| 5 | 43.00 | 81.90 | 37.10 | 54.00 |
| Junior High | 48.20 | 12.70 | 26.70 | 29.50 |
| Overall mean | 41.13 | 41.10 | 34.17 | 38.80 |

Table 11. Mean differences of pre- and post-test scores by group and grade: figural fluency

| Grade level | Group | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Overall mean |
| 4 | -1.50 | -0.70 | -0.40 | -0.87 |
| 5 | -2.70 | -3.90 | 3.60 | -1.00 |
| Junior High | 5.50 | 4.80 | 3.70 | 4.67 |
| Overall mean | 0.43 | 0.07 | 2.30 | 0.93 |

scores by group and grade. The overall mean difference was 0.93. The junior high had the highest mean difference, 4.67, with the other grades showing negative values, -0.87 (fourth grade) and -1.00 (fifth grade). Of the groups, the control group reported the highest mean difference of 2.30, followed by the workshop group with 0.43 and the in-service group with 0.07.

The F-values computed in the analysis of covariance were found to be nonsignificant. This analysis is shown in Table 12.

### Variable 5: Figural Flexibility

Mean post-test scores by group and grade for Figural Flexibility shown in Table 13 are the same as for Variable 4, shown in Table 10.

Table 12. Analysis of covariance of mean differences of pre- and post-test scores: figural fluency

| Source of variation | d.f. | Sum of Squares | Mean Square | F-value |
|---|---|---|---|---|
| Grade level | 2 | 535.39 | 267.70 | 4.66 |
| Group | 2 | 76.81 | 38.41 | 1 |
| Error | 4 | 229.86 | 57.47 | - |
| Student within class | 80 | 3754.20 | 46.93 | |
| Total | 86 | 4496.26 | | |

Table 13. Mean post-test scores by group and grade: figural flexibility

| | Group | | | |
|---|---|---|---|---|
| Grade level | Workshop | In-service | Control | Overall mean |
| 4 | 32.20 | 28.70 | 37.80 | 32.90 |
| 5 | 43.00 | 81.90 | 37.10 | 54.00 |
| Junior high | 48.20 | 12.70 | 27.60 | 29.50 |
| Overall mean | 41.13 | 41.10 | 34.17 | 38.80 |

The workshop group again had the highest mean, followed by the in-service group, and the control group.

Table 14 shows data concerning the mean differences of pre- and post-test scores by group and grade. The overall mean difference was -2.71. The greatest overall loss, -8.60, was reported by the control group.

Table 14. Mean differences of pre- and post-test scores by group and grade: figural flexibility

| | Group | | | |
|---|---|---|---|---|
| Grade level | Workshop | In-service | Control | Overall mean |
| 4 | 2.40 | .10 | -8.00 | -1.83 |
| 5 | -5.60 | -2.50 | -11.10 | -6.40 |
| Junior high | 3.80 | 3.20 | - 6.70 | 0.10 |
| Overall mean | 0.20 | 0.27 | - 8.60 | -2.71 |

The analysis of covariance of the effect of academic ability as measured by the Iowa Tests of Basic Skills is shown in Table 15. The F-value for grade level is again nonsignificant. However, the computed F-value of 24.53 for the experimental groups is significant at the .05 level.

Table 15. Analysis of covariance of mean differences of pre- and post-test scores: figural flexibility

| Source of variation | d.f. | Sum of Squares | Mean Square | F-value |
|---|---|---|---|---|
| Grade level | 2 | 403.48 | 201.74 | 6.30 |
| Group | 2 | 1571.89 | 785.94 | 24.53* |
| Error | 4 | 128.16 | 32.04 | - |
| Students within class | 80 | 3707.43 | 46.34 | |
| Total | 86 | 5810.96 | | |

*Significant at the .05 level.

The pooled regression coefficient was found to be -0.0253. Table 16 shows the resulting adjusted group means.

Table 16. Adjusted group means: figural flexibility

| Groups | Adjusted mean |
|---|---|
| Workshop | 0.26 |
| In-service | 0.33 |
| Control | -8.72 |

## Variable 6: Figural Originality

Mean post-test scores for Variable 6, Figural Originality, are shown in Table 17. The values are identical to those of variables 4 and 5, shown

Table 17. Mean post-test scores by group and grade: figural originality

| Grade level | Group | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Total |
| 4 | 32.20 | 28.70 | 37.80 | 32.90 |
| 5 | 43.00 | 81.90 | 37.10 | 54.00 |
| Junior high | 48.20 | 12.70 | 27.60 | 29.50 |
| Overall mean | 41.13 | 41.10 | 37.17 | 38.80 |

in Tables 10 and 13.

Mean differences of pre-test and post-test scores by grade and by group are outlined in Table 18. The overall value was 7.60. The greatest gain was recorded for the fifth grade in-service group, with a mean difference of 11.70, followed by the junior high in-service group with 11.40. The junior high control group registered the negative value of -18.20. Overall, the fifth grade and the in-service group had the greatest mean differences for the grades and groups, respectively, and the fourth grade and the workshop group reported the smallest mean differences.

Table 18. Mean differences of pre- and post-test scores by group and grade: figural originality

| Grade level | Group | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Overall mean |
| 4 | 1.30 | 1.30 | - .30 | .77 |
| 5 | - .30 | 11.70 | 6.40 | 5.93 |
| Junior high | 9.50 | 11.40 | -18.20 | .90 |
| Overall mean | 3.50 | 8.13 | - 4.03 | 7.60 |

Table 19 shows the analysis of covariance for Variable 6. Again, the computed F-values were found not to be significant.

Table 19. Analysis of covariance of mean differences of pre- and post-test scores: figural originality

| Source of variation | d.f. | Sum of Squares | Mean Square | F-value |
|---|---|---|---|---|
| Grade level | 2 | 506.51 | 253.25 | 1 |
| Group | 2 | 2288.99 | 1144.50 | 1.14 |
| Error | 4 | 2999.86 | 999.97 | - |
| Student within class | 80 | 25843.45 | 323.04 | |
| Total | 86 | 32628.81 | | |

## Variable 7: Figural Elaboration

Table 20 reveals that mean post-test scores by group and grade for Variable 7 are identical with those of variables 4, 5, and 6.

Table 20. Mean post-test scores by group and grade: figural elaboration

| | Group | | | |
|---|---|---|---|---|
| Grade level | Workshop | In-service | Control | Overall mean |
| 4 | 32.20 | 28.70 | 37.80 | 32.90 |
| 5 | 43.00 | 81.90 | 37.10 | 54.00 |
| Junior high | 48.20 | 12.70 | 27.60 | 29.50 |
| Overall mean | 41.13 | 41.10 | 34.17 | 38.80 |

Negative mean differences between pre- and post-test scores abound in Table 21. All overall values are negative, with the overall mean of -56.10. Only the fifth grade workshop group indicated a positive value, 4.20.

Analysis of covariance for Variable 7 is shown in Table 22.

Table 21. Mean differences of pre- and post-test scores by group and grade: figural elaboration

| Grade level | Groups | | | |
|---|---|---|---|---|
| | Workshop | In-service | Control | Overall mean |
| 4 | -21.20 | -18.80 | -14.60 | -18.20 |
| 5 | 4.20 | - 8.70 | -26.50 | -10.33 |
| Junior high | -36.90 | -34.20 | -11.60 | -27.57 |
| Overall mean | -17.97 | -20.57 | -17.57 | -56.10 |

Table 22. Analysis of covariance of mean differences of pre- and post-test scores: figural elaboration

| Source of variation | d.f. | Sum of Squares | Mean Square | F-value |
|---|---|---|---|---|
| Grade level | 2 | 6616.44 | 3308.22 | 1.34 |
| Group | 2 | 103.00 | 51.50 | 1 |
| Error | 4 | 9876.38 | 2469.09 | - |
| Student within class | 80 | 77881.19 | 973.51 | |
| Total | 86 | 94477.01 | | |

## Test of the Hypotheses

Hypothesis 1

> There is no significant difference among the groups as determined by the post-test minus pre-test difference scores of the students on the seven Torrance Tests of Creative Thinking.

On the basis of the analysis of covariance computed on mean differences between pre- and post-test scores, no significant values were found. Variable 5, Figural Flexibility, revealed a value significant at the .05 level. Therefore, hypothesis 1 could not be rejected, except for Variable 5, Figural Flexibility. There is no significant difference

between the groups in the other variables as measured by the Torrance Tests of Creative Thinking.

Hypothesis 2

> There is no significant difference among the grades as determined by the post-test minus pre-test difference scores of the students on the seven Torrance Tests of Creative Thinking.

The analysis of covariance computed on the mean differences between pre- and post-test scores was not found to be significant. Therefore, hypothesis 2 could not be rejected. There was no significant difference among the grades as determined by the mean difference scores of the students on the seven Torrance Tests of Creativity.

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Summary

### Problem

This study was an attempt to determine if students' ability to think creatively could be significantly increased by workshop and in-service training in creative teaching techniques for their teachers.

More specifically, the purpose of the study was to test the following null hypotheses:

1. There is no significant difference among the groups as determined by the post-test minus pre-test difference scores of the students on the seven Torrance Tests of Creative Thinking.
2. There is no significant difference among the grades as determined by the post-test minus pre-test difference scores of the students on the seven Torrance Tests of Creative Thinking.

### Experimental procedure

Nine teachers and 90 students participated in the study. Three of the teachers had participated in a series of workshops as part of Project IMPACT. Three had participated in a one-day in-service training program. Both of these experimental programs had concentrated on creative teaching techniques. The other three teachers were the control group and had no training in creative techniques. Each of the groups was composed of one fourth-grade, one fifth-grade, and one junior high teacher. Ten students in each teacher's class were selected at random to participate in the study.

These students were administered the seven subtests of the Torrance Tests of Creative Thinking in November of 1967 before any exposure to creative teaching techniques. Six months later, the students were given an equivalent form of the Torrance Tests of Creative Thinking.

Results

The analysis of covariance of the mean difference of pre- and post-test scores for each variable by grade and group was used to determine the effect of academic ability as measured by the Iowa Tests of Basic Skills. In only one variable, Figural Flexibility, was the computed F-value significant. This was at tne .05 level of significance.

Therefore, Hypothesis 1 could not be rejected, except for Variable 5, Figural Flexibility. Hypothesis 2 could not be rejected for any variable.

Limitations

1. More teachers came into contact with the students involved in the study than just those representing the teachers who had participated in workshops and in-service training. There was no way of limiting the contacts of the students tested to just those teachers who had participated in the workshops and in-service training for the experimental groups, or to just those teachers who had not participated in the experimental training for the control groups.

2. The selection of students required that the teachers of these students must have participated in in-service training or workshops on creativity. This narrowed down the possibilities considerably. With this criterion, it was impossible to select students strictly at random;

therefore, the sample was a selected sample rather than a true random sample.

3. The number of students tested was small. This resulted because the number of schools available and willing to participate was small. Also, the number of teachers participating was small. This considerably narrowed the number of students available to be tested. The time required to administer the test of creativity is considerable, and the scoring of this test is a very lengthy procedure. Therefore, test and time elements also necessitated that a small number of students be tested.

4. It was necessary to select the control group from students in another school district. This was not desirable, but the school district was chosen because of its similarity to the experimental group, both being suburban school districts of similar size and background.

5. The students being tested might have become conscious of the activity around them, causing a favorable reaction through an increased awareness of creativity because of the testing situation rather than from the influence of any new teaching techniques. This may have enhanced the possibility of the "Hawthorne Effect".

6. The training programs, particularly the in-service programs, were relatively short to expect a great deal of change in teaching methods.

7. The validity of the testing instrument may be questioned. Torrance (26) admits the instrument is still in the experimental stage. Other tests of creativity or other criteria of creative thinking may well have yielded different results.

Discussion

As stated in the Introduction, research in the area of creativity is relatively new. Therefore, many areas are open to question and exploration. Many of the problems in this study encountered are outlined in the Limitations section preceding this section.

The lack of significant results could be explained by many things. First, an objective definition of creativity itself hampers experimental efforts. Second, Project IMPACT, the workshop program, is certainly in the experimental stage. Perhaps methods other than those emphasized in these particular workshops and in-service training programs would bring about the desired increases in the ability to think creatively. Also, since creativity seems to be composed of more than one ability, different techniques may well be required to cultivate each one. Thirdly, the measure used may not have reflected some benefits or gains shown by the experimental groups.

Perhaps the most limiting factor of the study was the small sample. Only one teacher was used for each group and grade level. Therefore, the human factor enters and may well have influenced the results. The degree to which any teacher absorbed and used the creative teaching techniques would be impossible to measure. The effect of participation in the study itself upon the performance of the teacher is similarly difficult to ascertain. Also, with the wide range of literature in journals encouraging creative teaching experiences and techniques, any teacher may have done outside reading influencing her attitude or performance. There is also no reason to rule out the possibilities, indeed the assumption, that some of the teachers would use more creative teaching techniques,

without training, than others, even those with training.

## Conclusions

On the basis of the findings in this investigation, the following conclusions seem justified:

1. The workshop and in-service training programs for teachers did not result in significant increases in creative thinking ability as measured by the Torrance Tests of Creative Thinking.

2. Though the fifth grade tended to score higher than the other grades, this was due to initial differences rather than significant differences due to the effects of the experimental programs.

3. While these experimental programs may have merit, the procedures used in this study did not disclose any benefit derived from the experimental programs.

## Recommendations for Further Research

The exploratory nature of this study offers only a tentative evaluation of the workshop and in-service programs for instruction in creative teaching techniques. The following research may prove valuable in gaining further knowledge.

1. A longitudinal study should be done with teachers receiving extensive in-service training and workshop participation. This study should cover several years to observe long-term effects of creative teaching techniques. The numbers in the population should be greatly increased, both teachers and students, with a cross-sectional sample of socioeconomic and ability levels included. The students should be ob-

served for effects which may not be measured by the Torrance Tests of Creative Thinking.

2. Other instruments may well be used to measure creativity. The ability of the Torrance Tests of Creative Thinking to measure some areas of creative thinking, for example, composition of music or ability in art, may be lacking.

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# APPENDIX

Raw Scores (pre-test, post-test)

| Student no. | Verbal | | | Figural | | | |
|---|---|---|---|---|---|---|---|
| | Fluency | Flex. | Orig. | Fluency | Flex. | Orig. | Elab. |
| Control Group | | | | | | | |
| Fifth Grade | | | | | | | |
| 1 | 41,37 | 28,25 | 19,32 | 23,16 | 36,10 | 50,31 | 120,60 |
| 2 | 72,101 | 41,47 | 31,68 | 13,32 | 24,24 | 23,16 | 66,92 |
| 3 | 39,42 | 22,38 | 8,7 | 21,13 | 27,11 | 35,27 | 88,50 |
| 4 | 51,80 | 23,34 | 14,42 | 7,19 | 7,12 | 7,26 | 24,41 |
| 5 | 86,134 | 37,52 | 28,57 | 16,19 | 30,15 | 24,32 | 75,65 |
| 6 | 68,57 | 27,27 | 12,18 | 22,24 | 32,19 | 39,77 | 83,48 |
| 7 | 60,51 | 32,29 | 26,33 | 34,29 | 42,22 | 66,18 | 124,54 |
| 8 | 62,75 | 26,32 | 23,52 | 16,24 | 17,17 | 26,29 | 60,56 |
| 9 | 62,60 | 38,32 | 30,29 | 28,18 | 25,19 | 37,52 | 74,68 |
| 10 | 78,74 | 32,39 | 20,32 | 25,27 | 40,20 | 59,67 | 134,49 |
| Fourth Grade | | | | | | | |
| 1 | 58,38 | 23,25 | 6,10 | 14,16 | 15,12 | 25,15 | 59,58 |
| 2 | 70,39 | 37,30 | 32,18 | 33,25 | 37,19 | 62,26 | 88,69 |
| 3 | 68,55 | 28,28 | 15,16 | 9,18 | 14,13 | 15,21 | 71,103 |
| 4 | 72,58 | 41,34 | 21,39 | 11,13 | 11,12 | 24,29 | 48,40 |
| 5 | 33,21 | 22,13 | 7,8 | 10,11 | 14,9 | 21,36 | 76,53 |
| 6 | 24,12 | 14,9 | 4,3 | 13,8 | 14,8 | 18,15 | 53,25 |
| 7, | 64,51 | 33,31 | 19,34 | 23,16 | 32,16 | 48,69 | 83,75 |
| 8 | 82,70 | 37,33 | 36,46 | 22,26 | 29,19 | 43,19 | 76,45 |
| 9 | 51,41 | 26,31 | 12,21 | 15,17 | 24,12 | 45,34 | 89,56 |
| 10 | - ,27 | -,19 | -,11 | 17,13 | 22,12 | 25,11 | 56,37 |
| Junior High | | | | | | | |
| 1 | 61,51 | 31,33 | 13,20 | 14,16 | 16,14 | 12,41 | 50,59 |
| 2 | 35,24 | 17,13 | 8,15 | 20,22 | 20,13 | 29,11 | 55,56 |
| 3 | 50,43 | 31,28 | 18,30 | 22,16 | 48,19 | 52,17 | 52,40 |
| 4 | 63,58 | 37,35 | 13,24 | 15,19 | 15,17 | 38,10 | 52,17 |
| 5 | 52,46 | 29,33 | 13,25 | 10,21 | 19,18 | 12,13 | 71,44 |
| 6 | 53,48 | 27,26 | 12,23 | 21,18 | 23,13 | 80,9 | 75.61 |
| 7 | 46,45 | 30,30 | 13,27 | 9,14 | 101,113 | 12,6 | 36,42 |
| 8 | 74,59 | 40,37 | 29,41 | 26,34 | 37,28 | 49,30 | 131,81 |
| 9 | 100,60 | 41,28 | 28,25 | 28,19 | 41,16 | 46,8 | 117,63 |
| 10 | 72,45 | 35,29 | 15,22 | 16,21 | 27,16 | 26,24 | 84,44 |
| In-service Group | | | | | | | |
| Fourth Grade | | | | | | | |
| 1 | 41,26 | 20,21 | 13,10 | 24,28 | 20,16 | 28,29 | 65,55 |
| 2 | 54,54 | 33,28 | 16,17 | 22,17 | 18,10 | 19,10 | 91,120 |
| 3 | 22,58 | 16,26 | 5,24 | 28,28 | 18,20 | 10,20 | 92,68 |
| 4 | 36,65 | 15,27 | 3,26 | 34,34 | 20,26 | 5,22 | 54,69 |
| 5 | 55,58 | 29,27 | 17,20 | 35,24 | 20,17 | 17,17 | 92,47 |
| 6 | 55,27 | 16,22 | 22,20 | 18,17 | 13,10 | 19,27 | 63,52 |

| Student no. | Verbal | | | Figural | | | |
|---|---|---|---|---|---|---|---|
| | Fluency | Flex. | Orig. | Fluency | Flex. | Orig. | Elab. |
| 7 | 42,53 | 20,30 | 10,17 | 26,27 | 13,23 | 24,13 | 114,64 |
| 8 | 47,53 | 23,26 | 18,20 | 22,22 | 18,19 | 21,24 | 101,17 |
| 9 | 56,58 | 26,28 | 26,27 | 29,25 | 16,16 | 19,10 | 146,60 |
| 10 | 73,54 | 39,33 | 29,22 | 20,22 | 15,18 | 13,9 | 74,52 |
| Fifth Grade | | | | | | | |
| 1 | 41,43 | 24,29 | 12,24 | 20,22 | 16,2 | 23,7 | 73,73 |
| 2 | 38,35 | 24,24 | 12,12 | 13,11 | 11,11 | 19,15 | 90,83 |
| 3 | 50,62 | 30,18 | 34,25 | 15,9 | 7,6 | 8,39 | 79,51 |
| 4 | 38,66 | 26,38 | 34,29 | 23,25 | 13,16 | 10,10 | 67,65 |
| 5 | 24,43 | 15,25 | 21,18 | 12,14 | 11,13 | 9,8 | 43,41 |
| 6 | 98,76 | 33,38 | 33,30 | 21,20 | 19,2 | 18,2 | 39,60 |
| 7 | 78,76 | 32,24 | 37,38 | 22,10 | 18,2 | 15,2 | 45,70 |
| 8 | 63,26 | 31,21 | 32,32 | 21,17 | 15,18 | 21,14 | 51,63 |
| 9 | 32,47 | 11,27 | 15,16 | 25,14 | 18,12 | 12,37 | 68,69 |
| 10 | 74,- | 33,- | 32,- | 16,19 | 14,4 | 15,13 | 100,122 |
| Junior High | | | | | | | |
| 1 | 56,61 | 29,19 | 11,24 | 17,27 | 16,18 | 24,23 | 94,58 |
| 2 | 49,61 | 70,39 | 8,30 | 10,15 | 9,9 | 13,35 | 105,104 |
| 3 | 29,54 | 14,35 | 10,23 | 17,20 | 13,17 | 14,2 | 69,9 |
| 4 | 52,56 | 24,31 | 17,15 | 23,27 | 20,22 | 45,10 | 103,21 |
| 5 | 51,58 | 29,27 | 13,28 | 18,30 | 15,18 | 23,20 | 93,108 |
| 6 | 88,58 | 41,22 | 10,19 | 24,20 | 13,17 | 29,27 | 110,20 |
| 7 | 70,64 | 42,52 | 6,12 | 21,18 | 17,27 | 35,42 | 65,63 |
| 8 | 49,45 | 34,22 | 11,14 | 8,19 | 6,15 | 9,10 | 81,28 |
| 9 | 80,80 | 40,38 | 20,31 | 12,16 | 12,15 | 14,35 | 83,62 |
| 10 | 49,41 | 25,25 | 30,10 | 24,30 | 20,23 | 34,45 | 85,73 |
| Workshop Group Fifth Grade | | | | | | | |
| 1 | 53,79 | 27,50 | 17,66 | 18,16 | 18,15 | 25,49 | 77,59 |
| 2 | 54,35 | 30,26 | 18,18 | 28,12 | 22,11 | 26,55 | 129,59 |
| 3 | 66,94 | 31,49 | 20,38 | 21,18 | 17,16 | 25,20 | 146,75 |
| 4 | 41,29 | 27,18 | 13,11 | 21,20 | 15,9 | 23,20 | 66,72 |
| 5 | 36,27 | 25,21 | 28,13 | 10,13 | 6,12 | 9,14 | 57,90 |
| 6 | 40,49 | 27,24 | 30,24 | 16,9 | 13,7 | 17,43 | 81,37 |
| 7 | 60,81 | 36,32 | 23,28 | 11,11 | 10,11 | 12,21 | 69,48 |
| 8 | 25,40 | 30,17 | 24,13 | 15,14 | 14,10 | 17,37 | 64,116 |
| 9 | 44,46 | 30,17 | 24,13 | 16,11 | 11,9 | 14,27 | 96,62 |
| 10 | 76,78 | 34,41 | 34,44 | 19,12 | 11,12 | 12,11 | 130,70 |
| Fourth Grade | | | | | | | |
| 1 | 72,57 | 36,29 | 15,25 | 24,35 | 14,15 | 8,18 | 130,123 |
| 2 | 47,27 | 30,19 | 10,6 | 31,17 | 22,15 | 18,46 | 94,55 |
| 3 | 42,- | 25,- | 9,- | 35,18 | 20,14 | 26,16 | 164,16 |
| 4 | 11,50 | 9,26 | -,19 | 25,23 | 21,17 | 13,6 | 62,46 |
| 5 | 71,76 | 29,33 | 29,33 | 34,26 | 20,19 | 19,27 | 66,42 |

| Student no. | Verbal | | | Figural | | | |
|---|---|---|---|---|---|---|---|
| | Fluency | Flex. | Orig. | Fluency | Flex. | Orig. | Elab. |
| 6 | 53,43 | 25,24 | 11,18 | 27,29 | 21,32 | 16,20 | 87,90 |
| 7 | 73,132 | 34,53 | 18,76 | 26,40 | 17,22 | 24,19 | 165,119 |
| 8 | 57,33 | 32,20 | 14,14 | 25,25 | 15,21 | 24,10 | 54,45 |
| 9 | 66,31 | 25,29 | 7,23 | 34,28 | 18,21 | 32,38 | 109,85 |
| 10 | 47,75 | 26,34 | 9,28 | 22,27 | 18,24 | 19,12 | 41-49 |
| Junior High | | | | | | | |
| 1 | 74,53 | 32,29 | 12,13 | 12,20 | 8,16 | 9,29 | 72,22 |
| 2 | 75,68 | 37,35 | 11,17 | 12,19 | 9,10 | 7,52 | 62,9 |
| 3 | 48,82 | 26,47 | 11,51 | 13,15 | 12,12 | 22,5 | 92,31 |
| 4 | 98,89 | 48,48 | 43,53 | 14,24 | 12,18 | 29,29 | 87,88 |
| 5 | 41,36 | 25,27 | 15,18 | 11,20 | 11,20 | 23,27 | 53,26 |
| 6 | 49,73 | 28,35 | 17,29 | 15,11 | 11,11 | 24,18 | 82,27 |
| 7 | 60,60 | 30,26 | 18,16 | 19,25 | 14,20 | 36,25 | 135,98 |
| 8 | 103,102 | 44,44 | 33,40 | 17,10 | 13,8 | 18,17 | 71,32 |
| 9 | 98,89 | 48,45 | 59,30 | 15,25 | 14,19 | 13,52 | 57,33 |
| 10 | 105,113 | 54,52 | 62,29 | 9,23 | 8,16 | 18,40 | 52,28 |